Name of Organization: Case Western Reserve University

Type of Organization: College or University

Contact Information: Dr.   Douglas   Moog

Department of Geological Sciences

10900 Euclid Ave.

Cleveland   OH 44106

Phone: (216) 368 - 1688   **Extension:**

Fax: (216) 368 - 3691

E-Mail: dbm3@po.cwru.edu

Project Title: BMPs in the Maumee Watershed: Sediment and Nutrient Effects

Project Category: Habitat (Ecological) Protection and Rest

Rank by Organization (if applicable):   0

Total Funding Requested ($):   36,490   **Project Duration:**   0.5   Years

Abstract:

In the Maumee watershed, loads of sediment, nitrates, and phosphorus destroy habitat and pollute Lake Erie and rivers in the basin. The Maumee River Remedial Action Plan (RAP) identified five agricultural Best Management Practices (BMPs) to reduce these loads. Expansions in geographic data are rapidly improving abilities to simulate large-watershed BMPs. We are developing a model of the watershed which couples a GIS to a model of soil water movement and transport of sediment and nutrients. The model focuses on agricultural practices, including tile drainage, and is being calibrated for nitrate loss. The model will be able to address three of the BMPs, by varying winter cover, fertilizer application, and fall plowing. Support from GLNPO would enable us to simulate an additional BMP by including a riparian zone model; to include riparian zone systems in the GIS database; to incorporate sediment and phosphorus simulations by incorporating recent USGS NAWQA results and Heidelberg College data; and to perform simulations corresponding to RAP BMP goals. The result will be an ability to identify sensitive areas for BMP implementation, and to test and adjust BMP goals.

Geographic Areas Affected by the Project

States:

☐ Illinois	☐ New York
☐ Indiana	☐ Pennsylvania
☐ Michigan	☐ Wisconsin
☐ Minnesota	☒ Ohio

Lakes:

☐ Superior	☒ Erie
☐ Huron	☐ Ontario
☐ Michigan	☐ All Lakes

Geographic Initiatives:

☐ Greater Chicago   ☐ NE Ohio   ☐ NW Indiana   ☐ SE Michigan   ☐ Lake St. Clair

Primary Affected Area of Concern: Maumee River, OH

Other Affected Areas of Concern:

For Habitat Projects Only:

Primary Affected Biodiversity Investment Area:

Other Affected Biodiversity Investment Areas:

Problem Statement:

The Maumee River watershed is the largest in the U.S. Great Lakes and, according to the EPA, is the largest source of sediment and phosphorus discharged to Lake Erie, contributing 46 percent of phosphorus and 37 percent of sediment, but only 3 percent of flow. Nitrate loads per unit basin area are among the highest in the nation. The lower Maumee basin was designated an Area of Concern by the U.S.-Canada Great Lakes Water Quality Agreement, owing primarily to agricultural runoff, and is the subject of an EPA Remedial Action Plan (RAP).

These elevated levels derive primarily from agriculture, which accounts for 88 percent of the land use in the watershed. Sediment loads have destroyed fish habitat - for example, lake sturgeon in the Maumee River and Lake Erie - transportied pollutants, and filled Toledo Harbor, for which dredging costs run several million dollars per year. Nutirents contribute to eutrophicaton and nitrate concentrations which regularly exceed drinking-water standards.

Some progress has been seen over the past several decades, particularly in soluble phosphorus, and this may be ascribed largely to agricultural best management practices (BMPs). However, since 1975, trends in total phosphorus, sediment, and nitrate have not been of high statistical significance, ranging from slight decreases (total phosphorus) to slight increases (nitrates). While some BMPs, notably conservation tillage, have been widely adopted, farmers have been more resistant to others, such as riparian zone buffers, which would impose costs. Recent research indicates that others, such as fertilizer management, have the potential to cut costs, but have not yet been widely implemented, as more specific knowledge is needed. In addition, other practices, such as tile drainage, may be exacerbating problems such as nitrate loads.

While habitat loss and pollution due to sediment and nutrient loads in the Maumee River watershed show some response to BMPs, continued improvement is far from assured, and the BMP potential remains far from realized.

Proposed Work Outcome:

Our work will focus on the BMPs promoted by the Maumee RAP:

1) Plant grasses, legumes, or small grains to provide seasonal protection when the major crops are not in the field.
2) Establish strips of trees or shrubs between fields as a wind break.
3) Establish vegetation along all streams to filter out sediment from runoff water.
4) Plan fertilizer applications carefully to prevent nutrient loss. Consider timing and placement. Don't apply chemicals where they can easily wash into a ditch, or just before a thunderstorm.

5) Local agricultural non-point source steering committees should encourage farmers to
adopt BMPs, and give up the practice of fall plowing.

Recent expansions in the availability of geographic data have rapidly improved capabilities for modeling large watersheds, including BMPs. With support from the Lake Erie Protection Fund, we at Case Western Reserve University have been developing a model which couples GIS (Arcinfo) coverage of the watershed to an agricultural model (ADAPT) of soil water transport, including loss of sediment, nitrates, and phosphorus through runoff and leaching, including the effects of tile drainage. We have been focusing on nitrate loads, and with capabilities of the current model will be able to address BMPs 1, 4, and 5 above: winter cover, fertilizer application, and fall plowing.

Support from GLNPO will enable us to expand model capabilities and perform simulations in support of the Maumee RAP BMPs. The expanded capabilities include:

- Modeling effects of riparian zone buffers, to incorporate BMP 3, by:
    - including the REMM model as has been implemented at Ohio State
    - developing GIS coverage of existing riparian zones
- Sediment and phosphorus modeling, through:
    - calibration to loads monitored by the Water Quality Laboratory at Heidelberg College
    - incorporation of recent sediment results from the USGS NAWQA

The simulations will calculate nitrate, sediment, and phosphorus loads, focusing on the lower Maumee River down to Waterville. They will be based on both current conditions and BMP goals in consultation with the Maumee RAP. Variations in BMPs will be peformed to identify the most responsive regions, effective practices, and potential successes. In this regard, the recent work on BMP economics at the Ohio State University as part of the Lake Erie Agricultural Systems for Environmental Quality program (USDA) will be consulted, as it identifies the most cost-effective programs to date.

In the future, additional funding will be sought to provide more detailed tile drainage coverage, perhaps through remote sensing; and to develop a stand-alone application which may be used directly by others to explore management scenarios.

Project Milestones:	Dates:
Project Start	07/2000
Incorporation of REMM (riparian model)	08/2000
Riparian zone GIS coverage	10/2000
Model recalibration with new data	11/2000
Baseline simulation (current conditions)	11/2000
Formulation of scenario alternatives	11/2000
Simulation of BMP goals and alternatives	12/2000
Project End	12/2000

☐   Project Addresses Environmental Justice

If So, Description of How:

☐   Project Addresses Education/Outreach

If So, Description of How:

Project Budget:

	Federal Share Requested ($)	Applicant's Share ($)
Personnel:	18,000	3,000
Fringe:	3,960	770
Travel:	1,500	0
Equipment:	0	0
Supplies:	150	0
Contracts:	0	0
Construction:	0	0
Other:	0	0
Total Direct Costs:	23,610	3,770
Indirect Costs:	12,880	1,998
Total:	36,490	5,768
Projected Income:	0	0

Funding by Other Organizations (Names, Amounts, Description of Commitments):

Funding for the development of the computer application to be used in this research is currently supported by the Lake Erie Protection Fund on a grant of $90,593.

Description of Collaboration/Community Based Support:

The proposed research is designed to support the goals of the Maumee RAP and will be pursued in consultation with that group and other interested parties, including farmers, NRCS, Ohio EPA, Army Corps, and ODNR. Our current program has been built in collaboration with researchers at Ohio State and Hedidelberg College under USDA LEASEQ program, and this collaboration is expected to continue.